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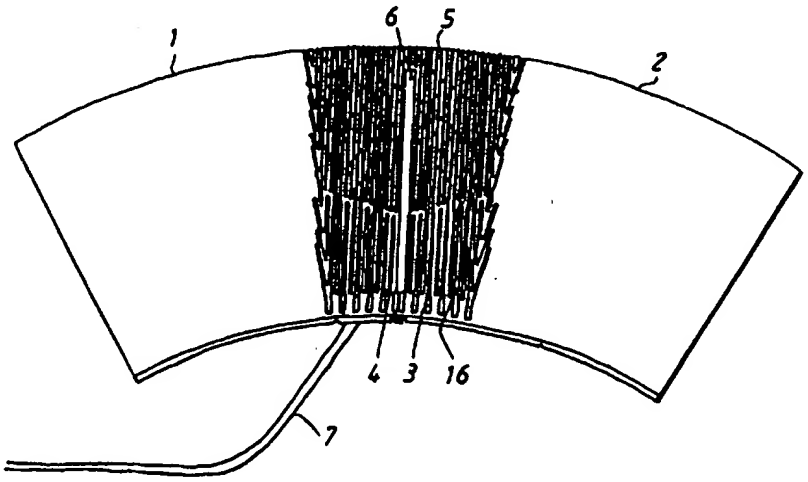

(57) Abstract

During refining/beating of beating material there exists a need to measure more parameters than the gap, directly in the beating zone. The present invention makes this possible and it relates to a system for continuous measuring of pressure and temperature in the beating zone and the system is characterized in that a number of separate/combined pressure sensors or temperature sensors provided with cables are applied on or in at least one of the homogeneous beating discs or, beating discs constructed of segments, of the refiner along the active radius of the beating disc, alternatively are arranged in at least one position between, alternatively between and in, two of the segments being present in the beating disc along the active radius of the beating disc and that the cables are collected into a bunch of cables or are transformed into another cable and leave the beating disc via a hole therein, if the beating disc is stationary, to be connected to a possible detecting unit and a subsequent presentation unit, alternatively, if the beating disc rotates, that the bunch of cables/the cable is connected to a collector shoe arranged against the shaft of the refiner with further connection according to the above.

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System for continuously measuring pressure and temperature in the beating zone of refiners

Technical area

The present invention relates to a system for continuously measuring pressure and temperature in the beating zone of refiners used within the pulp and paper industry and similar industry. During production of high yield pulps, for example thermomechanical pulp (TMP) and chemithermomechanical pulp (CTMP), from lignocellulosic material such as wood chips, different refiners have a central position. Refiners are usually used also during production of semi-chemical pulp. Further, refiners are used during paper production for beating different types of cellulose pulp, both pulps which contain larger or smaller amounts of lignin and pulps which are free of lignin, such as chemical pulps bleached to a very high whiteness. Refiners are also used within other industrial branches, such as for instance in the production of woodfibre boards.

The present invention is applicable in all technical areas where refiners are used.

Prior art

Most refiners contain two beating discs between which the material which is to be treated is passed. Usually one of the beating discs is stationary while the other is rotating with high speed. The beating material is in most cases introduced into the refiners via the centre of the beating discs and if the beating material, for example, consists of wood chips this will be disintegrated on its way out to the periphery of the beating discs. If the beating material consists of cellulose pulp, what is desired is not usually disintegration of the material but a change of the pulp fibres so that these form a better, for example a

stronger, paper than if the pulp fibres have not been treated in this way.

The diameter of the beating discs varies. This depends for example on the make and the capacity of the refiner. Earlier, the beating discs were cast in a single piece but today the beating discs are predominantly built of a plurality of segments. The segments may extend from the centre of the beating disc to its periphery. However, it is usual that two rings of segments (an inner and an outer ring) make up the disc.

Refiners are also known where both the beating discs rotate in opposite directions to each other and refiners are also known having four beating discs in which a rotor in the middle part has beating discs mounted on both sides.

In the production of, for example, TMP from wood chips the beating discs are pressed together so that the gap of the beating zone will become approximately 0,2 - 0,6 mm. An increase of the gap by, for example, 10% is very significant to the properties of the pulp. It is therefore important to have knowledge of the actual gap of the beating gap. Beating gap meters, for example in the form of inductive centres, which are applied to the refiners are available on the market. Usually, only one gap meter is used for each beating zone, primarily with the aim of avoiding contact of the beating discs and thus not primarily to regulate the gap, which normally decreases from the centre out to the periphery.

Moreover, there are no real measuring systems in the refiner. However, there are instruments located in the forward flowing pulp by which a number of pulp characteristics can be determined. With the aid of measured

pulp characteristics and the present width of the gap, the operator of the refiner can regulate the TMP production.

The invention

Technical problem:

As is evident from the above, only a few measurements are performed in the refiner itself and therefore there is a need to measure more parameters such as the pressure and temperature existing in the refiners.

The solution

The present invention solves this problem and relates to a system for continuously measuring pressure and temperature in the beating zone of refiners used within the pulp and paper industry and similar industry, characterised in that a number of separate pressure sensors or temperature sensors or combined pressure and temperature sensors provided with cables are applied on or in at least one of the homogeneous beating discs of the refiner or beating discs made up of segments along the active radius of the beating disc or alternatively are positioned between, alternatively between and in, two segments of the beating disc along the active radius of the beating disc and that the cables are collected into a bunch of cables or are transferred to another cable and leave the beating disc via a hole therein, if the beating disc is stationary, to be connected to a possible detecting unit and a subsequent presentation unit, alternatively, if the beating disc rotates, that the bunch of cables or the cable is connected to a collector shoe applied against the shaft of the refiner from where connection leads to a possible detection unit and a subsequent presentation unit.

According to a preferred embodiment of the invention, the pressure and temperature sensors are partly housed in a parallelepipedic, elongated bar extending along the active

radius of the beating disc with at least three sides including one front side having several recesses facing the beating material and that the sensor (contact) part of the pressure and temperature sensors are arranged in the recesses and that the bar is anchored to the beating disc or in the segment or between and/or in two segments.

The expression "the active radius of the beating disc" denotes that part of the radius of the beating disc where the main refining and/or beating work occurs. In beating discs which are made up of segments which form an inner and an outer ring, the main refining and/or beating work usually occurs in the outer ring. In those cases where also the treatment of the beating material which occurs in the inner ring is of distinct importance for the process, that part of the beating disc radius is also included in the expression "active radius". The length of the elongated bar coincides with or is, for example, somewhat shorter than the height of the segments in the outer ring. This is the usual construction, but as a consequence of the above, the length of the bar can substantially coincide with the height of both the segment rings, that is the bar extends from the centre of the beating disc to each periphery. With regard to the depth of the bar, it is less than the material thickness of the segments, preferably some millimetres less. The space for the bar is created, for example, by milling out material in a segment. It is preferred that the bar is located between two segments. This can be done by leaving a gap the width of which coincides with the width of the bar when mounting two segments in the stator lying behind. It is especially suitable that a space in the edge part of each segment is milled out between two segments, which space corresponds to half of the volume of the bar. It is of course fully possible, instead of milling out in whole segments, to

create a space for the bar already during the production of the segments.

Instead of fastening the sensor (contact) part of the pressure and temperature sensors in the front side of the bar it is possible to attach it to a plate the surface and construction (recesses) of which substantially coincide with the front side of the rod and this plate is preferably releasably attached to the front side of the rod. The pressure and temperature sensors extend in this case from the plate and through the recesses (holes) in the front side of the bar into the bar. A cable runs from each sensor, which cables are guided within the bar towards a hole which is made in the bar and this bunch of cables, or one cable, to which the different cables have been collected is connected via a hole in the stator situated behind to a detecting unit in the way described above.

By means of, for example, some screws the plate may be connected to the front side of the rod in holes provided with corresponding threads. It will thus be possible in a simple way to release the plate with the attached measuring sensors and, if so desired, to investigate these and possibly change any measuring sensors that are out of order or have a malfunction. In this way, the bar will remain in the beating disc or the segment during the whole lifetime of the beating disc, whereas the measuring sensors can be simply changed when necessary, for example if the pressuring sensors have a shorter lifetime than the beating disc. For reasons of time, it may be advantageous to replace the whole segment with a new segment containing a new set of measuring sensors.

A beating segment has a great number of bars. Some of the bars extend all the way from the inner edge of the segment to its outer edge, i.e. its and the beating disc's

periphery. The bars usually run not completely parallel but slightly conically from the inner edge of the segment having their greatest distance at the inner edge. Crossbars run between the bars at certain distances, at least with regard to the outer half of the segment, i.e. the half situated towards the periphery, forming a space. According to one embodiment of the invention, a number of pressure and temperature sensors are arranged in at least two, for example three, of the already existing spaces including a space confined only by bars. These groups of pressure and temperature sensors are arranged in radial direction. In this embodiment of the invention it is neither necessary nor suitable to use bars for anchoring of the measuring sensors as these can be anchored, for example by filling the remaining space with some suitable material. For example, the filling may be carried out with some material in melt condition which, after being cooled, surrounds and anchors the measuring sensors in the segment. It should be simplest to provide the beating segment with the described arrangement already during the production of the beating segment. It should also be simplest to manufacture the passage for the cable at that time.

Small fibreoptic pressure sensors which are suitable to use are already on the market. The actual sensing part is applied, for example, in the end of a cylindrical sleeve which extends horizontally, for example through the recess in the above described front side of the bar and into the bar. The cable through which the measuring signal is forwarded is connected to the sensor part and leaves the sleeve at the opposite side.

Piezoresistant pressure sensors may also be used.

With regard to the temperature sensors, there exist so-called resistance elements, for example so called PT-100

elements, which can be used for measuring the temperature. In a similar way as described above, the element may be applied in one end of a cylindric sleeve, which end faces the beating material or, alternatively, is applied directly on the surface of the bar and encapsulated in a suitably durable material.

The above described sensors are separate sensors, which means that the pressure sensor and the temperature sensor are arranged in the vicinity of each other in a certain position but at a certain distance from each other. In this way, the temperature which corresponds to the pressure in a certain point or surface in the beating zone of the refiner is not measured, but instead a certain difference will arise since the measuring sensors are arranged close to each other but not at the same point or surface.

Therefore, such sensors are desired which measure both the pressure and the temperature in one and the same point or on a well defined smaller surface. Such fibreoptic sensors are today under development and these are due for immediate application. Measuring sensors based on other measuring principles are also under development today.

From a function and maintenance point of view, the sensing part of the above described sensors should be located in a plane which is one millimetre or some millimetres from the plane where the bars in the beating segment meet the beating material.

According to a further embodiment of the invention a measuring rod is used where both temperature sensors and the pressure sensors are made up of plane resistance elements, so called PT-100 elements. Similarly to what has been described above with relation to the elongated bar, this measuring rod extends along the active radius of the

beating disc. Such a measuring rod may, for example, be constructed of a first and a second metal plate. On the second metal plate, which is applied in a direction towards the beating material, a number of resistance elements which measure the pressure are, for instance, attached to the inner side of the plate whereas a number of resistance elements, which measure the temperature, are attached to the outer side of the plate. A layer of, for example epoxy polymer or polyimide material is applied between the two plates and on the outer side of the second metal plate, which means that said resistance element is enclosed and protected by these two layers. As usual, cables run from each measuring sensor.

With regard to the number of measuring points/surfaces along the active radius of the beating disc and thus also the number of attached pressure and temperature sensors, it is the case that the more measuring points/surfaces the more accurate description is obtained of the refining/beating process. At least approximately 8 beating points/surfaces are desired.

Hitherto, only measuring of pressure and temperature along the active radius of the beating disc in one position has been mentioned, but it is of course fully possible to make such measurements in two or more positions. For example, two of the above described measuring devices may advantageously be mounted diagonally upon the beating disc, i.e. opposite each other at either side of the centre of the beating disc.

As has been stated earlier, the measuring signals are collected and detected in some preferred cases in a special unit. One example of such a unit is transmitter TRI22 manufactured by INOR for signals from resistance elements. A suitable unit for fibreoptic signals is the

optoelectrical unit SIA 1000 manufactured by SAMBA SENSOR, consisting of couplings, emitters and detectors/amplifiers. In both cases a voltage signal is obtained which can be sent further via a band cable and conventional measuring card to a measuring computer (personal computer) and/or a printer.

If the outsignals from the pressure and temperature sensors are received as an electric voltage, the signals may be sent directly via, for example, a band cable to a conventional measuring card and further to a computer and/or a printer.

The above described measuring cards plus measuring computer and/or printers are examples of a presentation unit.

In the case where the beating disc having pressure and temperature sensors rotates, microwave technique, for example, can also be used to transmit the measuring signals from the measuring points to the detecting unit followed by the presentation unit. This is suitably carried out by means of a transmitting unit coupled in connection to the pressure and temperature sensors. The transmitting unit may obtain its supply of electric current via a collector shoe. Alternatively, energy may be supplied by microwaves from an external unit. These microwaves are received by a unit in the refiner which transforms them to a suitable feed, i.e. electric current, for example to the resistance elements and light, for example to the fibreoptic pressure sensors.

Advantages

Experiments have shown that it is possible to measure both pressure and temperature within the refiners and especially along the active radius of the beating disc. This opens up the possibility to follow in a better way than before, for example the fibre disintegration process during production

of TMP, and to regulate this production, which in turn results in an optimising of the process and/or to an end product with higher quality, i.e. pulp. Changes in the pressure and temperature profile of a single refiner may sometimes be the result of heavy wear on the beating disc/segment, which means that when the measuring system according to the invention is used a quicker indication of this is received so that the beating disc/segment can be replaced.

Also when the refiner is used for beating cellulose pulp in a paper production plant, it is of greatest importance to be able to measure the pressure and temperature within the refiner. Further, the measuring system according to the invention is of great help when beating segments having varying and/or new patterns are tested.

Description of the figures

In fig 1 two beating segments are shown, in the end parts of which a recess has been milled out so that a bar with attached pressure and temperature sensors included in the measuring system according to the invention can be located and anchored.

In fig 2 only the same bar is shown and in fig 3 a plate is shown which is attached to the front side of the bar, being parts of preferred embodiments of the invention.

Fig 4 shows measured pressure and temperature curves at the passage of the beating material between and along the beating discs using the measuring system according to the invention.

Best embodiment

In the following, preferred embodiments of the invention will be described with reference to the figures and the invention will be further explained in more detail.

As stated above, current beating discs are usually constructed of a great number of beating segments arranged in an inner and an outer ring. Behind the segments is a homogeneous disc called a stator. The segments are fastened to the stator by means of bolts which are inserted in threaded recesses on the rear side of the segments.

In fig 1 two segments 1 and 2 are shown in the outer ring. Material thickness of the segments calculated from the rear surface to the base surface may be approximately 30 mm. A great number of extended bars 3 protrude from the base surface, which bars run in the direction of the radius from the inner side of the segment to its periphery. Some of the bars 4 are cut shorter than the others. On the part of the segment towards the periphery crossbars 5 run between the elongated bars. In fig 1 the beating pattern has been drawn only on a part of the segments. The shown pattern runs and is repeated along every segment in the outer ring.

At the edge parts of the two segments 1 and 2 a recess has been milled out so that the two segments together make the elongated rectangular recess 6. The recess goes straight through the segment 1 and 2. At the rear side of the segment 1 a casing shoe 7 has been attached through which a bunch of cables runs (will be described later).

The bar 8 shown in fig 2 conforms to the recess 6 and is introduced therein from the rear side. The bar 8 presents two crossbars 9 and 10. Corresponding recesses are arranged on the rear side of the segments 1 and 2 at either side of the recess 6. The bars 9 and 10 conform precisely to said

recess and by bolting the two segments 1 and 2 to the located behind stator the bar 8 will be anchored in a very stable way in said position. The front side 11 of the bar 8 has a large number of round holes 12. In these holes and preferably slightly outside, the sensing parts of the pressure sensors and temperature sensors are mounted. It is almost a condition that these sensors are small and occupy a little space. Such sensors are currently available on the market, as stated above. The measuring sensors can either be cylindric, having the sensing part in one end, or the measuring sensors can be very thin, for example so called PT-100 elements, and in these cases it is suitable to attach the element in one end of a cylindric sleeve. All or the main part of this cylindric (the section does not, of course, have to be round but can have many geometric forms) objects extends horizontally within the bar 8. The object can be attached to the bar 8 in any known way. For example, the objects may be provided with threads and thus be threaded in threads in the front side 11 which surround the recesses or holes 12. One or more cables run from the opposite side of the object, i.e. compared to the sensing part which faces the beating material, and the cable or cables from the measuring sensors are arranged to run within the bar 8 to a larger recess or hole 13. This bunch of cables (or several cables collected into one cable) leaves the bar 8 through the hole 13 and runs further for example through the casing shoe 7 to a hole in the stator located behind and further to any of the earlier mentioned detecting units.

The bar 8 shown in fig 2 is more shallow at its upper quarter part (approximately). This depends on the fact that the stator located behind has a protrusion or head which runs along the periphery of the stator and therefore all segments, including the segments 1 and 2, have corresponding indentations or recesses and this in turn

determines the shown shape of the bar 8. If the stator of the refiner is even, the bar 8 may advantageously have one and the same height along the whole bar. Further the bar 8 may both be without and have a rear wall (back side). The location of the hole 13 is adapted to where the hole is located in the stator behind. The number of holes 12 in the bar 8 is determined by how many measuring points are wanted in the particular case.

The plate 14 shown in fig 3 is a part of an embodiment of the measuring system according to the invention which is especially preferred. Instead of attaching the pressure and temperature sensors to or in the bar 8 it is in some cases better to attach these in or on the plate 14. The surface of the plate corresponds substantially to the surface of the front side 11 of the bar 8. The holes and the recesses 15 correspond to the holes 12 in the front side 11 of the bar 8. In this case the holes 12 are only used as passages for the measuring sensors. Some of the holes in the plate 14 as well as in the front side 11 of the bar 8 can be used for anchoring the plate 14 to the bar 8. The anchoring can be done by screws introduced in some of the holes 15 and screwed into corresponding holes provided with threads. With this arrangement it is easy to, for example, inspect the measuring sensors by removing the plate 14 and pulling it out thereby to disclosing the measuring sensors via the passage through the hole 12 in the bar 8. If any measuring sensor needs to be exchanged it is easy to do so. According to this embodiment of the pressuring system, according to the invention the bar 8 may remain intact in the beating segment or beating segments during their entire lifetime. In the embodiment of the beating system according to the invention which appears in figs. 1 and 2 it is necessary, when replacing, for example, a measuring sensor, to release both segment 1 and segment 2 from the stator located behind

and in this way reach the bar 8 and thereby also the measuring sensors.

It appears from fig. 1 that the recess 6 (and thereby also usually the bar 8) is shorter than the height of the segment in the direction of the radius. The recess 6 and the bar 8 can of course be both shorter or longer than the length which is shown in fig 1. For example, the recess 6 and the bar 8 may extend along the entire height of the segment. Further, the recess 6 is not necessary under all circumstances and the bar 8 can be located in a gap between two beating segments. Additionally, a recess 6 does not have to be located in the joint between two segments but can be located anywhere within a segment and possibly dividing the segment in two parts.

As is evident from what is stated above, it is not necessary, according to the invention, to use a bar for anchoring and protection of the measuring sensors, but instead these can be mounted directly in the beating disc or the beating segments. Holes which conform to the volume of the measuring sensors can be made in the segments between the longitudinal bars 3 and 4 (see fig 1). The measuring sensors can advantageously be spread out along the radius of the beating disc or the segment. For example, two pairs of measuring sensors or two combined measuring sensors can be located between two bars from the lower edge of the segment to the cut 16. The next two pairs of measuring sensors can be located in a space which follows the cut 16 in the direction of the radius and which is confined by two longitudinal bars and two crossbars 5. It is completed by, for example, two pairs of measuring sensors in a corresponding space almost at the end or at the end towards the periphery of the segment. These measuring sensors may be anchored in any way desired in the segment. For example, it is possible to fill the space

surrounding the measuring sensors with some material which, after the filling, solidifies and thus maintains the measuring sensors in a firm grip. It is also possible to obtain a good anchoring by means of wings extending from the measuring sensors, or other protruding elements, and recesses in the segment adapted to these. Also in this case, the sensing part of the measuring sensors should be a millimetre or some millimetres under the upper edge of the bars 3 and 4.

In fig 4 it is shown how the pressure and the temperature are kept along the radius of the beating disc. The centre of the beating disc ends at a radius length of 150 mm and it is from a radius length of 450 mm out to the periphery of the beating disc, i.e. approximately corresponding to the segment of the outer ring on the beating disc,that both the pressure and the temperature vary. It is this part of the beating disc which is described in this patent application as the active radius of the beating disc. The curves are produced by means of a measuring system according to the invention. The arrangement shown in figs. 1 and 2 was included in said measuring system. A plurality of pressure sensors of the fibreoptic type was set out. From each pressure sensor the signal went via glass fibre conductors to a detecting unit comprising an optoelectrical unit of the type SAMBA Sensors and from there the transformed signal went to a measuring card in a measuring computer which in turn was coupled to a printer. A plurality of temperature measuring sensors where arranged in the vicinity of the pressure sensors. The sensing part of these measuring sensors consisted of a thin resistance element of the type PT-100. The signal was transmitted via cables to a transmitter TRI22 manufactured by INOR. The voltage signal received went via a band cable to a measuring card in a measuring computer which in turn was coupled to a printer.

To operate the measuring system a feeding aggregate transmitting an electric current with a voltage of 24 volts was used. From the feeding aggregate a first cable was connected to a transmitter from where a further cable was connected to the resistance element. A second cable went from the feeding aggregate to an optoelectrical unit where the electric current was transformed to light, which light was sent to the pressure sensor by means of a fibreoptic cable (glass fibre conductor).

The presence of feeding aggregates and means to transfer various forms of energy to the measuring sensors has not earlier been explicitly disclosed and in each individual case this is required, as will easily be understood by the person skilled in the art. For example, the expression "a cable provided with a sensor" thus normally implies that a cable is connected to the sensor parallel with the one which is connected from the sensor. This means that every cable contains at least two conductors. It is of course possible that feeding aggregates of another voltage than 24 volts can be used.

From the tests which have been performed and the result of which is exemplified in fig. 4, it appears that, by means of a measuring system according to the invention, it is possible to follow both the temperature and the pressure along the beating disc, i.e. in the beating zone during the travel of the beating material through the refiners. Measured values relate to tests according to the TMP-process, i.e. disintegration of wood in the shape of chips to cellulose pulp.

CLAIMS

1. System for continuous measuring of pressure and temperature in the beating zone of refiners used in the pulp and paper industry and similar industry
c h a r a c t e r i z e d i n that a number of separate pressure sensors and temperature sensors or combined pressure and temperature sensors provided with a cable are applied on or in at least one of the homogeneous beating discs or beating discs made up of segments along the active radius of the beating disc or alternatively are arranged in at least one position between, or alternatively between and in, two of the segments of the beating disc along the active radius of the beating disc and that the cables are collected into a cable bunch or are transferred into another cable and leave the beating disc via a hole therein, if the beating disc is stationary, to be connected to a possible detector unit and subsequent presentation unit, alternatively, if the beating disc rotates, that the cable bunch or the cable is connected to a collector shoe arranged against the shaft of the refiner wherefrom connection leads to a possible detection unit and subsequent presentation unit.

2. System according to claim 1,
c h a r a c t e r i z e d i n that the pressure and temperature sensors are partially housed in a parallelepipedic elongated bar extending along the active radius of the beating disc having at least three sides including one front side provided with more recesses facing the beating material, and that the sensing (contact) part of the pressure and temperature sensors are arranged in the recesses and that the bar is anchored in the beating disc or in the segment or between and/or in two segments.

3. System according to claim 2,
c h a r a c t e r i z e d i n that the sensing (contact) part of the pressure and temperature sensors, instead of being located in the front side of the bar, are arranged in a plate the surface and the construction (recesses) of which substantially coincide with the front side, and that the plate is attached to the front side of the bar.

4. System according to claim 1,
c h a r a c t e r i z e d i n that the pressure and temperature sensors are arranged in already existing spaces between bars in the beating disc or segments in at least two positions.

5. System according to claims 1-4,
c h a r a c t e r i z e d i n that the pressure sensors are of a fibreoptical type.

6. System according to the claims 1-4,
c h a r a c t e r i z e d i n that the pressure sensors are of a piezoresistive type.

7. System according to the claims 1-6,
c h a r a c t e r i z e d i n that the temperature sensors consist of resistance elements.

8. System according to the claims 1-7,
c h a r a c t e r i z e d i n that the number of pressure sensors or temperature sensors or combined pressure and temperature sensors is 8 or more.

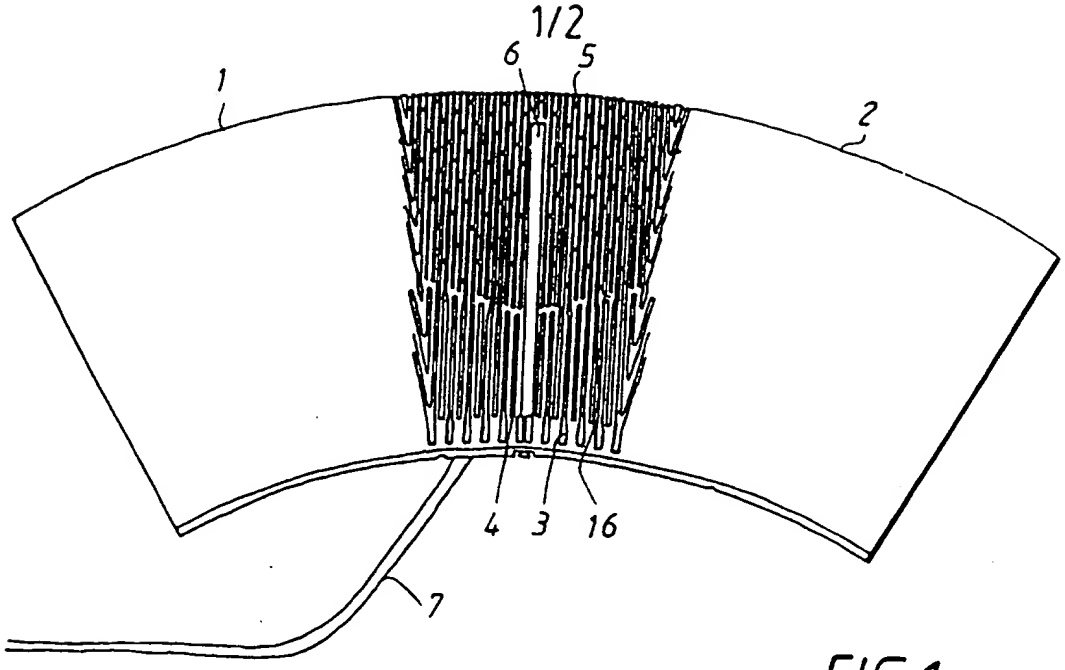

FIG.1

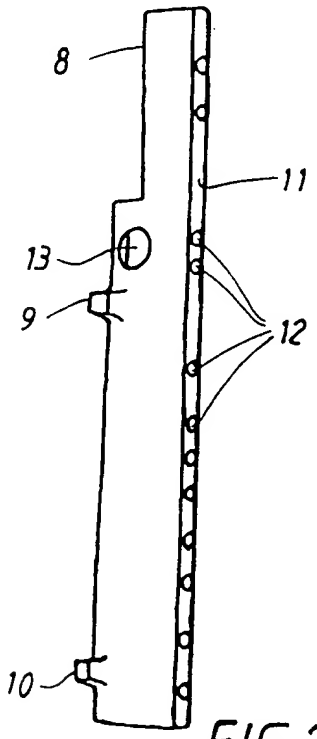

FIG.2

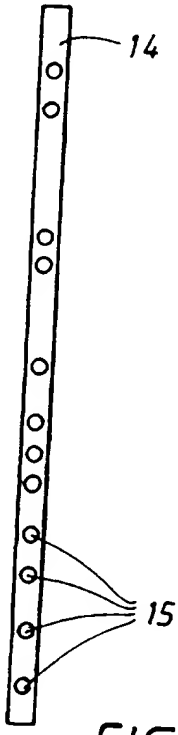

FIG.3

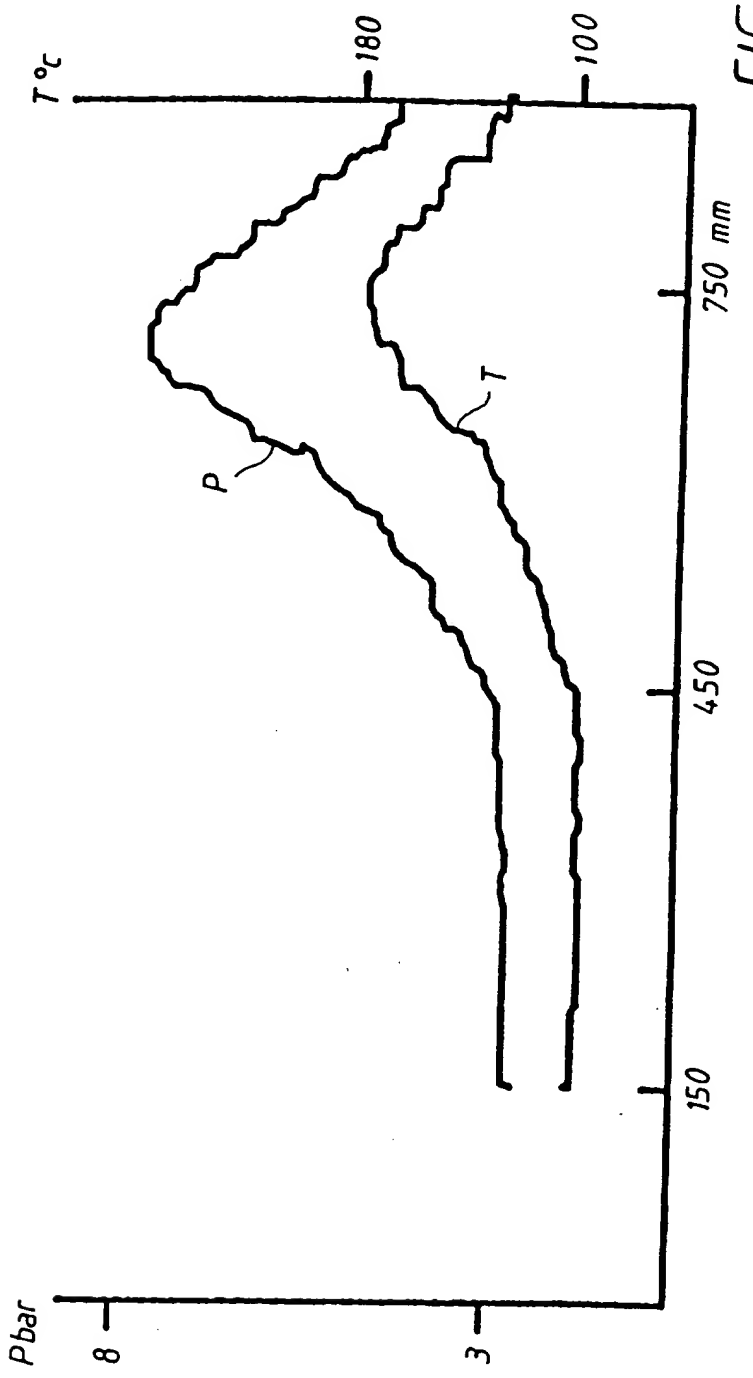

FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/01279

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B02C 7/14, D21D 1/30
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B02C, D21B, D21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, CLAIMS, PAPER CHEM

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4148439 A (MATS FLODEN), 10 April 1979 (10.04.79), page 1, column 2, line 11 - column 2, line 48, figures 2,3, claim 2, abstract --	1-8
A	DE 2554961 A1 (YHTYNEET PAPERITEHTAAT OY JYLHÄVAARA), 17 March 1977 (17.03.77), figure 4 --	1
A	CH 546600 A (KORUMA-MASCHINENBAU PAUL HAUSER), 15 March 1974 (15.03.74) --	1-8

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 February 1996	07-02-1996
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Henrik Fehninger Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

05/01/96

International application No.
PCT/SE 95/01279

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4148439	10/04/79	CA-A- 1053050	24/04/79
		DE-A- 2702735	04/08/77
		FR-A,B- 2339703	26/08/77
		GB-A- 1546978	06/06/79
		JP-A- 52110907	17/09/77
		SE-B,C- 407952	30/04/79
		SE-A- 7601019	31/07/77
DE-A1- 2554961	17/03/77	FR-A,B,B 2323808	08/04/77
		GB-A- 1468649	30/03/77
		JP-A- 52034001	15/03/77
		SE-A- 7513500	10/03/77
CH-A- 546600	15/03/74	DE-A- 2145096	11/01/73